SUGAR BEET (*Beta vulgaris*)
Rhizomania; *Beet necrotic yellow vein virus*
Storage rot; *Athelia*-like sp., *Botrytis* sp., *Penicillium* sp., and *Phoma* sp.

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Experimental sugar beet cultivars evaluated for rhizomania resistance and storability in Idaho, 2012.

Twenty-six experimental sugar beet cultivars and a rhizomania susceptible check cultivar were evaluated in a sprinkler-irrigated sugar beet field near Kimberly, ID where barley was grown in 2011. The trial was conducted in a field that contained Portneuf silt loam soil and relied on natural infection for rhizomania development. The field was fall plowed and in the spring, fertilized (90 lb N and 110 lb P_2O_5/A) and roller harrowed on 16 Apr 12. The plots were planted on 23 Apr to a density of 142,560 seeds/A, and thinned to 47,520 plants/A on 14 Jun. Plots were four rows (22-in. row spacing) and 24 ft long. The experimental design was a randomized complete block design with four replications per cultivar. The crop was managed according to standard cultural practices. The plot was rated for the percentage of plants with foliar rhizomania symptoms on 13 Jul. The plants were mechanically topped and the center two rows were dug with a mechanical harvester on 3 Oct. At harvest, the roots were evaluated for rhizomania using a scale of 0-9 (0 = healthy and 9 = dead) in a continuous manner. The percent sucrose at harvest was established based on two eight-root samples from each plot. The samples were submitted to The Amalgamated Sugar Co. Tare Lab (determined percent sucrose, conductivity, nitrates, and tare). At harvest, eight roots per plot were also placed in a mesh onion bag, weighed, and placed in an indoor commercial sugar beet storage facility in Paul, ID on 3 Oct set to hold 34°F. On 13 Feb 13, roots were retrieved after 134 days in storage and evaluated for surface root rot (% of root area), weight, and percent sucrose (via gas chromatography). Only samples from the same plots were compared, when establishing percent reduction in sucrose at harvest versus storage. Data were analyzed using the general linear models procedure (Proc GLM-SAS), and Fisher's protected least significant difference was used for mean comparisons.

Root rots and other disease problems other than rhizomania were not evident in the plot area. There were significant differences among cultivars for all variables, except weight reduction. Rhizomania was uniform based on foliar (81.5%) and root (4.08) symptoms in the susceptible check, B-103. All cultivars exhibited good rhizomania resistance, since cultivars had foliar ratings $\leq$ 4% and root ratings < 3.0, which were both significantly less than the susceptible check. Root yield averaged 36.76 t/A, which was similar to Idaho's average of 35.3 t/A (USDA-National Ag. Stat. Service) and also indicates rhizomania resistance was adequate. After 134 days in storage, surface root rot ranged from 34 to 90%, weight loss ranged from 8.4 to 15.4%, sucrose losses ranged from 33 to 72%, and ERS ranged from 1,997 to 7,601 lb/A. Given these response ranges, selecting cultivars for rhizomania resistance and combining it with storability will lead to considerable economic benefit for the sugar beet industry.

Cultivar [u]	Rhizomania rating[t]		Surface root rot (%)[v]	Weight reduction (%)[w]	Root yield (t/A)	ERS at harvest (lb/A)[x]	Sucrose reduction (%)[y]	ERS after storage (lb/A)
	Foliar (%)	Root						
SX022	1.2 b	2.20 d-h	34 j	8.4	38.34 a-e	11,395 a-d	33 i	7,601 a
SX021	0.2 b	1.85 hi	49 c-j	10.7	41.26 a	12,150 a	44 e-i	6,837 ab
SV016	0.2 b	2.42 b-f	35 ij	9.5	36.36 d-f	11,261 a-d	41 g-i	6,719 a-c
C-36	0.2 b	2.30 d-g	42 g-j	11.9	38.26 a-e	11,191 b-d	41 f-i	6,614 a-c
HM 124268	1.0 b	2.25 d-g	54 b-j	9.5	38.51 a-e	11,260 a-d	44 e-i	6,279 a-d
C-34	1.2 b	2.32 d-g	47 e-j	10.9	37.53 b-f	11,367 a-d	45 d-i	6,257 a-d
12SYN001	0.5 b	2.50 b-e	48 d-j	10.6	35.55 ef	9,994 f	38 hi	6,202 a-e
SV015	0.5 b	2.18 e-i	65 a-h	12.7	38.30 a-e	11,694 ab	49 c-i	5,881 a-f
M 124896	0.2 b	2.40 b-f	76 a-c	12.1	36.61 d-f	10,760 b-f	46 c-i	5,861 a-f
B-50	0.2 b	2.50 b-e	46 f-j	10.9	36.86 c-f	11,028 b-e	47 c-i	5,844 a-f
HM 126648	0.0 b	2.45 b-f	55 b-j	11.0	36.36 d-f	10,734 c-f	48 c-i	5,578 a-g
SV014	0.8 b	2.48 b-f	58 b-j	11.8	35.94 d-f	10,614 d-f	48 c-i	5,496 a-h
C-35	0.5 b	2.35 d-f	67 a-h	13.0	38.14 a-e	11,189 b-d	53 a-i	5,276 b-i
SV017	1.0 b	2.10 f-i	69 a-g	12.1	39.76 a-c	11,031 b-e	54 a-i	5,059 b-j
12MAR001	0.0 b	2.40 b-f	42 h-j	11.6	35.78 d-f	10,060 f	51 b-i	4,923 b-j
M 125594	0.2 b	2.58 b-d	58 b-j	13.3	34.75 fg	10,054 f	53 a-i	4,624 c-j
12SYN003	0.2 b	2.18 e-i	67 a-h	13.6	38.88 a-d	10,657 d-f	58 a-h	4,476 d-j
HM 125891	0.0 b	1.80 i	74 a-d	11.4	41.15 a	11,142 b-d	59 a-g	4,464 d-j
SX018	1.5 b	2.30 d-g	71 a-f	11.6	37.34 b-f	10,580 d-f	58 a-h	4,437 d-j
B-48	4.0 b	2.75 bc	57 b-j	10.0	32.26 g	9,848 f	55 a-h	4,426 d-j
12SYN002	0.5 b	1.95 g-i	74 a-e	10.7	40.22 ab	11,228 a-d	62 a-e	4,130 e-j
B-49	1.8 b	2.15 e-i	76 a-c	10.8	40.20 ab	11,610 a-c	65 a-d	4,058 f-k
SX007	0.2 b	2.38 c-f	80 ab	11.9	36.25 d-f	9,942 f	64 a-e	3,492 g-k
HM 126457	0.5 b	2.78 b	89 a	13.7	32.02 g	10,000 f	66 a-c	3,409 h-k
HM 123367	0.2 b	1.82 hi	90 a	13.6	40.87 a	11,479 a-d	72 a	3,255 i-k
12SYN004	0.2 b	2.35 d-f	68 a-h	12.5	37.25 b-f	10,180 ef	70 ab	3,041 jk
B-103	81.5 a	4.08 a	62 b-i	15.4	17.82 h	4,816 g	61 a-f	1,997 k
Overall mean	3.7	2.36	61	11.7	36.76	10,639	53	5,046
$P > F$[z]	<0.0001	<0.0001	0.0010	0.7312	<0.0001	<0.0001	0.0172	<0.0001
LSD	6.6	0.40	27	NS	3.12	941	21	2,118

[t] Foliar = percentage of foliage in plot with rhizomania symptoms on 13 Jul. Root = roots were evaluated for rhizomania using a scale of 0 to 9 (0 = healthy, 9 = dead; Plant Dis. 92:581-587) in a continuous manner at harvest.

[u] For more information on coded cultivars, contact the following companies: B = Betaseed Inc., C = ACH Seeds Inc., HH = Holly Hybrids, HM = Hilleshog, M or MAR = Maribo, SV = SESVanderHave, SYN = Syngenta, and SX = Seedex. The rhizomania susceptible check cultivar (bold) was B-103.

[v] Surface root rot = percentage of root surface area discolored in storage.

[w] Weight reduction = difference in weight from harvest to end of storage.

[x] ERS = estimated recoverable sucrose was calculated as extraction x 0.01 x gross sucrose and extraction = 250 + [1255.2 x (conductivity -15000) x (percent sucrose - 6185)]/(percent sucrose x [98.66 - (7.845 x conductivity)]).

[y] Sucrose reduction (%) = (1-(((% $\text{Sucrose}_{\text{storage sample}}$ – 1.395) x $\text{Weight}_{\text{storage sample}}$)/(% $\text{Sucrose}_{\text{harvest sample}}$ x $\text{Weight}_{\text{harvest sample}}$))) x 100.

[z] $P > F$ was the probability associated with the F value. Within each variable, means followed by the same letter did not differ significantly based on Fisher's protected least significant difference (LSD; $\alpha = 0.05$). NS = not significant.